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Abundance and Run Timing of Adult Pacific Salmon in the East Fork Andreafsky River, Yukon Delta National Wildlife Refuge, Alaska, 2011

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Cover Photo: USFWS Fisheries Technician sampling a Chinook salmon at the East Fork Andreafsky River weir 2011.

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Abstract

A resistance board weir was used to collect abundance, run timing, and biological data from salmon returning to the East Fork Andreafsky River, a tributary to the lower Yukon River, from June 20 to July 30, 2011. An estimated 5,213 Chinook salmon *Oncorhynchus tshawytscha* migrated through the weir. Four age groups were identified from 650 Chinook salmon sampled, with age 1.2 (43%) dominant. The sex composition was 20% female. An estimated 100,473 summer chum salmon *O. keta also* migrated through the weir. Five age groups were identified from 1,005 summer chum salmon sampled, with ages 0.3 (35%) and 0.4 (65%) dominating. The sex composition was 45% female. An estimated 1,219 pink salmon *O. gorbuscha*, and 500 sockeye salmon *O. nerka*, were counted as they passed through the weir. Other species counted during 2011 included 2,115 whitefish (Coregoninae), one Dolly Varden *Salvelinus malma*, and 23 northern pike *Esox lucius*.

Introduction

The Alaska National Interest Lands Conservation Act (ANILCA), signed into law December 2, 1980, mandates salmon populations and their habitats be conserved within National Wildlife Refuge lands, international treaty agreements be fulfilled, and a subsistence priority for rural residents be maintained (USFWS 1991). Compliance with ANILCA mandates cannot be ensured without reliable data on salmon stocks originating from and returning to refuge lands. The Andreafsky River is one of several lower Yukon River tributaries on the Yukon Delta National Wildlife Refuge (Refuge). The Andreafsky River and its primary tributary, the East Fork Andreafsky River, provide important spawning and rearing habitat for Chinook salmon *Oncorhynchus tshawytscha*, summer chum salmon *O. keta*, coho salmon *O. kisutch*, pink salmon *O. gorbuscha*, and sockeye salmon *O. nerka* (USFWS 1991). The Andreafsky River supports one of the largest returns of Chinook salmon, the second largest return of summer chum salmon (Bergstrom et al. 1998), and is believed to have the largest return of pink salmon in the Yukon River drainage (USFWS 1991). Furthermore, the Andreafsky River salmon stocks contribute to a significant subsistence fishery in the lower Yukon River.

Consequently, the need for accurate and timely escapement estimates from tributaries like the Andreafsky River are required for managers to help determine exploitation rates, spawner-recruit relationships and maintain genetic diversity for the Yukon River basin (Labelle 1994). Throughout the Yukon River Basin there are a limited number of monitoring projects that collect these data. Therefore, Federal and State fishery managers utilize information from escapement projects as well as main-stem sonar stations and test fisheries to distribute salmon harvest over time to avoid over-harvesting an individual salmon stock (Mundy 1982). However, due to run

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timing or the estimated abundance of returning individual stocks, certain stocks may be incidentally over-harvested in the subsistence, commercial, or sport fisheries.

Escapement monitoring on the East Fork Andreafsky River started with aerial surveys by the U.S. Fish and Wildlife Service (USFWS) from 1954-1960, and continued by the Alaska Department of Fish and Game (ADF&G) from 1961 to the present. Sonar and tower count methods were added by ADF&G from 1981 through 1988 (Appendix 1). The present weir project (operated by the USFWS Kenai Fish and Wildlife Field Office from 1994-2002 and the USFWS Fairbanks Fish and Wildlife Field Office from 2003-present) provides accurate escapement and biological data dating back to 1994 for Chinook salmon, summer chum salmon, and pink salmon, as well as coho salmon from 1995 to 2005. The Andreafsky River weir is one of the longest running escapement projects in the Yukon River drainage.

Poor salmon returns from 1998 – 2002 in the Yukon River resulted in harvest restrictions, complete fishery closures, and spawning escapements below management goals on many tributaries in the Yukon River drainage (Vania et al. 2002; Kruse 1998, JTC 2012). Chinook salmon and summer chum salmon runs improved with harvestable surpluses from 2002-2006 (JTC 2007). However, Chinook salmon runs again showed low run strength from 2007-2011. This project provides helpful information on tributary run strength and quality of escapement for in-season management decisions, especially during years with low returns as it is one of the few escapement projects that monitor populations that are below the majority of the harvest on the Yukon River.

Objectives

Specific objectives of the 2011 project were to: (1) enumerate adult salmon escapement; (2) describe run timing of Chinook salmon and summer chum salmon returns; (3) estimate the age, sex, and length composition of the adult Chinook salmon population; (4) estimate age, sex, and length composition of the adult summer chum salmon population; and (5) identify and count other fish species passing through the weir.

Study Area

The Andreafsky River is located in the lower Yukon River drainage in western Alaska (Figure 1). The regional climate is subarctic with extreme temperatures reaching 28˚ C in summer and – 42˚C in winter at St. Mary's, Alaska (Leslie 1989). Mean July high and February low temperatures between 1976 and 2000 were 18˚C and – 22˚C, respectively. Average yearly precipitation is approximately 48 cm of rain and 172 cm of snow. The Andreafsky River ice breakup typically occurs in May or early June, and usually begins to freeze in late October (USFWS 1991). Maximum discharge typically follows breakup. Sporadic high discharge periods generated by heavy rains occur between late July and early September.

The Andreafsky River is one of the three largest Yukon River tributaries within Refuge boundaries (USFWS 1991) and drains a watershed of approximately 5,450 km^2. The main stem Andreafsky River and the East Fork Andreafsky River parallel each other flowing in a southwesterly direction for more than 200 river-kilometers (rkm) and converge 7 rkm above their confluence with the Yukon River. The mouth of the Andreafsky River is approximately 160 rkm upstream from the mouth of the Yukon River. The main stem Andreafsky River and East Fork

Andreafsky River flow through the Andreafsky Wilderness and the portions of each river within Refuge boundaries are designated as Wild and Scenic Rivers.

The East Fork Andreafsky River originates in the Nulato Hills at approximately 700 m elevation and drains an area of about 1,950 km^2 (USFWS 1991). The river cuts through alpine tundra at an average gradient of 7.6 m per km for 48 rkm. It then flows for 130 rkm through a forested river valley bordered by hills that rarely exceed 400 m elevation. Willow, spruce, alder, and birch dominate the riparian zone and much of the hillsides. This forested river section drops at an average rate of 1.4 m/km and is characterized by glides and riffles with a gravel and rubble substrate. The river widens in the lowermost 38 rkm and the gradient changes to 0.14 m/km. The valley here is a wetland, interspersed with forest and tundra, and bordered by hills that are typically less than 230 m elevation. Aquatic vegetation grows in the slower flowing stream channels. Water level fluctuations on the Yukon River also affect the stage height in the lower sections of the East Fork and main stem Andreafsky Rivers.

Methods

Weir Operation

A modified resistance board weir (Tobin 1994; Tobin and Harper 1995; Zabkar and Harper 2003) spanning 105 m was installed June 18-20, 2012 in the East Fork Andreafsky River (62° 07' N, 162° 48.4'W) approximately 43 rkm upstream from the Yukon-Andreafsky River confluence and 26 air-km northeast of St. Mary's, Alaska (Figure 1). The weir site is located approximately 2.4 rkm downstream from the 1994 weir site described by Tobin and Harper (1995) and 2.1 rkm downstream from the 1981-1988 sonar and counting tower site described by Sandone (1989). Weir panel picket spacing (4.8 cm inside edge to inside edge) was designed to remain functional during higher water flow, but allowed some small pink salmon and resident fish to pass through the weir undetected (Zabkar and Harper 2003).

A staff gauge was installed upstream of the weir to measure daily water levels. Staff gauge measurements were calibrated to a monument with the three-foot mark on the staff gauge twelve and half feet below the horizontal from the monument. Two Onset Hobo Pro v2 (Bourne, Massachusetts) loggers collected water temperature throughout the season, and were left on site to collect data year round. Water temperatures and chemistry were collected twice daily at approximately 7:30 am and 7:30 pm, using a YSI Professional Plus Multiprobe (Yellow Springs, Ohio); the data is presented in Appendix 9.

Two passage chutes were installed, one approximately one-third of the way across from the left bank and the other centered between the banks, in water deep enough to allow fish passage in the event of low water. A fish trap was installed on one of the passage chutes to facilitate biological sampling. All fish were enumerated and identified to species as they passed through the live trap, except whitefish spp., which were grouped together under the subfamily Coregoninae. Fish were counted 24 hours per day from June 20th to July 30th and the numbers were recorded hourly

The weir was cleaned and its integrity visually checked daily. Cleaning consisted of raking debris from the upstream surface of the weir or walking across each panel to submerge it enough to allow the current to wash debris downstream. Repairs were made when necessary.

Biological Data

Adult salmon counting and sampling occurred daily as they migrated through the weir live trap to determine run timing and escapement. Floy tags were used to mark all sampled Chinook salmon so individuals could be identified in carcass surveys carried out after weir operations ceased. A stratified random sampling design (Cochran 1977) was used to collect age, length, and sex ratio information for summer chum salmon. Biological sampling of Chinook salmon and chum salmon commenced at the beginning of each week, and the weekly sampling goal was 160 salmon/species/week spread over a minimum four-day period, with daily sampling spread out over the entire 24 hours. All target species within the trap were sampled to prevent bias. Non-target species were identified and counted, but not sampled, with the exception of whitefish of which opportunistic samples were taken and sacrificed to construct a gonadosomatic index. The data from this sampling effort are being recorded into a database for future analyses and will not be discussed further in this report.

Fish sampling consisted of identifying salmon species, determining sex, measuring length, collecting scales, and then releasing the fish upstream of the weir. Secondary external characteristics were used to determine sex. Additionally a Signostics phantom II, (Palo Alto, California) hand-held ultrasound unit was used to determine sex on all sampled salmon. Length was measured from mid-eye to the fork of the caudal fin and rounded to the nearest 5 mm. Scales were removed from the area above the lateral line and posterior to the dorsal fin following the methods outlined by Koo (1962) and Devries and Frie (1996). Three scales were collected from each Chinook salmon sampled, and one scale was collected from each summer chum salmon sampled. Scales were sent to ADF&G post season for age determination, and impressions were made on cellulose acetate cards using a heated scale press and examined with a microfiche reader (Zabkar and Harper 2003). Age was determined by an ADF&G biologist and reported according to the European method (Koo 1962). Daily sex ratios were collected by visually examining each fish for external morphological features when sampling for age and length. The daily escapement counts and sex ratios were reported daily to the USFWS Fairbanks Fish and Wildlife Field Office and forwarded to ADF&G staff.

Data Analysis

Calculations for age and sex information were treated as a stratified random sample (Cochran 1977), with sampling weeks as the strata. Age 1.2 Chinook salmon were assumed to be males (Brady 1983; Bales 2007; Karpovich and DuBois 2007) regardless of their field determination. Each statistical week was defined as beginning on Sunday and ending the following Saturday. Incomplete weeks, or weeks with low passage, were combined with the week after the beginning of weir operation or with the week before the end of weir operation. Within a stratum, the proportion of the samples composed of a given sex or age, $\hat{p}_{ij}$, was calculated as

$$\hat{p}_{ij} = \frac{n_{ij}}{n_j},$$

where n_{ij} is the number of fish by sex i or age i sampled in week j, and n_j is the total number of fish sampled in week j. The variance of $\hat{p}_{ij}$ was calculated as

$$\hat{v}(\hat{p}_{ij}) = \frac{\hat{p}_{ij}(1-\hat{p}_{ij})}{n_j - 1}.$$

Sex and age compositions for the total run of Chinook and summer chum salmon of a given sex or age, $\hat{p}_i$ were calculated as

$$\hat{p}_i = \sum_{j-1} \hat{W}_j \hat{p}_{ij,}$$

where the stratum weight $\hat{W}_j$ was calculated as

$$\hat{W}_j = \frac{N_j}{N},$$

and N_j equals the total number of fish of a given species passing through the weir during week j, and N is the total number of fish of a given species passing through the weir during the run. Variance, $\hat{v}(\hat{p}_i)$ of sex and age compositions for the run was calculated as

$$\hat{v}(\hat{p}_i) = \sum_{j-1} \hat{W}_j^2 \hat{v}(\hat{p}_{ij}).$$

Salmon for which age could not be determined, were apportioned to age classes using the method described by Eisermann and Knight (2005). This was done to utilize weir data which could affect the weighted apportionment by strata.

Results and Discussion

Weir Operation

The weir was operational from June 20 through July 30, 2011. One high water event hindered weir operation in 2011, which caused a four-hour period for which counts were extrapolated. The average river stage height during weir operations was 116 cm and ranged between 103 cm and 140 cm (Figure 2). Water temperature during weir operations averaged 11.4°C and ranged between 8.4 and 13.8°C (Figure 2, Appendix 9).

Biological Data

An estimated 5,213 Chinook salmon, 100,473 summer chum salmon, 1,219 pink salmon, and 500 sockeye salmon migrated through the weir in 2011 (Table 1). Passage estimates for Chinook and summer chum salmon were conservative due to an unknown number of fish passing before and after the weir was operational. Non-salmon species recorded moving through the weir included 2,115 whitefish, 1 Dolly Varden, and 23 northern pike.

The East Fork Andreafsky River weir recorded above average Chinook salmon escapement (Figure 3); however, the 2011 drainage wide Chinook salmon run was assessed to be below average. The summer chum salmon escapement recorded at the weir was above average (Figure 3). Concurrently, the drainage wide summer chum escapement levels were assessed to be above average in 2011 (JTC 2012).

Chinook Salmon

The 2011 Chinook salmon escapement estimate (5,213 fish) was above the 1994-2010 historical average of 4,487 fish (Figure 3; Appendix 2). Peak passage (517) occurred on July 19 (Table 2; Figure 4). The 2011 run timing was near average. The first quartile passed on July 9 (historical average July 5), the mid-point of the run at the weir was July 12 (historical average July 9), and the third quartile passage date was July 20 (historical average July 15) (Appendix 2). (Chinook salmon calculations were not adjusted for differences in project duration between years).

Of the 5,213 Chinook salmon that passed through the weir in 2011, 650 (12.5% of the run) were sampled for age, sex, and length information. Female Chinook salmon lengths ranged from 475 to 955 mm, and male Chinook salmon ranged from 360 to 945 mm (Table 3). Of the 650 Chinook salmon sampled for age composition 107 (16%) were classified as unreadable, primarily due to scale regeneration. The age composition of the remaining 543 sampled Chinook salmon included four age groups: age 1.2 (43%), age 1.3 (41%), age 1.4 (15%), and age 1.5 (<1%) (Table 4). Females composed an estimated 20% of the overall escapement (Table 4). This estimate is 17% lower than the historic sex ratio (Appendices 7 and 8). The age distributions of female and male Chinook salmon were different, with ages 1.3 and 1.4 dominating at 37% and 58% for females, and ages 1.2 and 1.3 dominating at 52% and 43% for males.

The 2011 ADF&G aerial survey conducted on the Andreafsky River estimated 1,141 Chinook salmon for the main stem and 620 Chinook salmon for the East Fork (Appendix 1). The main stem aerial count was within ADF&G's Sustainable Escapement Goal (SEG) of 640 to 1,600 Chinook salmon, and the East Fork was below the SEG of 960-1,900 Chinook salmon (Hayes and Newland, 2009). In 2010, the East Fork aerial SEG was converted to a weir goal of 2,100-4,900 for Chinook salmon, which was surpassed this year

Summer Chum Salmon

The 2011 summer chum salmon escapement estimate of 100,473 fish was above the 1994-2010 historical average of 74,188 fish (Figure 3; Appendix 1 and 3), and met the ADF&Gs' Biological Escapement Goal (BEG) of 65,000 to 130,000 fish (JTC 2012). Peak passage (8,644 fish) occurred on July 9 (Table 1; Figure 4). The 2011 run timing was near average. The first quartile passed on July 2 (historical average July 2), the mid-point of the run at the weir was July 8 (historical average July 6), and the third quartile passage date was July 12 (historical average July 12) (Table 2). Summer chum salmon calculations were not adjusted for differences in project duration between years.

Female summer chum salmon lengths ranged from 435 to 615 mm and male summer chum salmon ranged from 475 to 670 mm (Table 3). A total of 1,002 summer chum salmon were sampled for age composition, with 58 (6%) classified as unreadable, primarily due to scale regeneration. The age composition of the remaining sampled summer chum salmon included four age groups: age 0.2 (<01%), age 0.3 (35%), age 0.4 (65%), and age 0.5 (<01%) (Table 5). Females comprised an estimated 39% of the overall escapement (Table 5). This estimate is 8% lower than the historic sex ratio (Appendix 8). Female summer chum salmon were predominantly age 0.3 at 35% and age 0.4 at 65%, and male summer chum were predominantly age 0.3 at 33% and age 0.4 at 66%.

Pink Salmon

Pink salmon have strong runs to the East Fork Andreafsky River during even-numbered years and relatively weak runs during odd-numbered years (Appendix 5). The 2011 escapement through the weir (1,219 fish) was less than the odd-year 1995-2009 historical average of 9,433 fish. However, the 2011 pink salmon escapement estimate was incomplete since weir operation ceased before the end of the run. Pink salmon counts on the Andreafsky River are not a precise estimate but are a measure of relative year-to-year abundance as small pink salmon being able to pass uncounted between the weir pickets. Peak passage (653 fish) occurred between July 25th and July 30th, with the highest single day passage occurring on July 27th (183 fish) (Table 1, Appendix 5).

Sockeye Salmon

The 2011 sockeye salmon escapement estimate of 500 fish was above the 1995-2010 historical average of 221 fish (Appendix 6). However, the 2011 sockeye salmon escapement estimate was incomplete since weir operation ceased before the end of the run. Large populations of sockeye salmon are absent in the Yukon River drainage (Bergstrom et al. 1995), but small populations have been identified in several Yukon River tributaries (Alt 1983; O'Brien 2006), including the Andreafsky River.

Conclusion

The East Fork Andreafsky River weir has been an important tool for monitoring salmon stocks originating in the Refuge, and assisting both ADF&G and USFWS inseason managers with management of Yukon River fisheries. Due to the complexity of the Yukon River mixed-stock salmon fishery and the difficulty in managing specific stocks, it is vital to continue collecting information from individual salmon populations, including stocks in the Andreafsky River drainage. The East Fork Andreafsky weir is unique in that it is the only enumeration project in the lower river downstream of the Pilot Station sonar. The numerical, biological, and run timing information collected from the East Fork Andreafsky weir project is assumed to be representative of other Lower Yukon River systems experiencing lower salmon exploitation due to their location in the lower portion of the Yukon River drainage. This project allows managers to evaluate escapement goals, analyze trends in population size, length, age, and gender, formulate run projections, determine harvest allocations, and monitor long-term changes associated with climate change, harvest fluctuations, diseases, and other stressors.

Investigations into spawning and rearing locations for sockeye salmon are recommended to assure long-term viability of this small unique population. Additionally, with the introduction of a limited commercial fishery for Arctic lamprey in 2003, the East Fork Andreafsky River weir project provides a platform to collect baseline data to better understand lamprey biology, relative abundance, and distribution, and to construct a sampling protocol in light of the developing commercial fishery and historical subsistence use. Developing an opportunistic sampling regime or pilot study examining the juvenile and adult lamprey at this site could help further the knowledge of this species in the Yukon River drainage.

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Table 1.—Salmon escapement estimates, by stratum, recorded at the East Fork Andreafsky River weir, Alaska, 2011.

Stratum Date	Chinook salmon	Chum salmon	Pink salmon	Sockeye salmon
June 20-26	2	4798	13	31
June 27-July 3	138	28,219	0	197
July 4-10	1,653	32,297	1	135
July 11-17	1,463	25,764	29	67
July 18-24	1,719	7,313	523	53
July 25-30	238	2,082	653	17
Total	5,213	100,473	1,219	500

Table 2. — Daily and cumulative estimates of Chinook salmon, summer chum salmon, pink salmon, and sockeye salmon, and daily and total estimates, whitefish spp., and northern pike escapement through the East Fork Andreafsky River weir, Alaska, 2011.

Date	Chinook salmon		Chum salmon		Pink salmon		Sockeye salmon		Whitefish	Northern Pike
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Daily
20-Jun	0	0	146	146	0	0	1	1	81	0
21-Jun	0	0	19	165	0	0	0	1	32	1
22-Jun	0	0	2	167	0	0	0	1	18	0
23-Jun	0	0	21	188	0	0	3	4	11	0
24-Jun	0	0	1,294	1,482	2	2	5	9	19	0
25-Jun	1	1	2,935	4,417	11	13	12	21	31	2
26-Jun	1	2	381	4,798	0	13	10	31	44	0
27-Jun	1	3	1,088	5,886	0	13	16	47	13	2
28-Jun	0	3	684	6,570	0	13	18	65	16	1
29-Jun	9	12	2,522	9,092	0	13	31	96	37	1
30-Jun	25	37	4,900	13,992	0	13	33	129	39	1
1-Jul	29	66	5,090	19,082	0	13	42	171	82	2
2-Jul	41	107	7,241	26,323	0	13	33	204	52	0
3-Jul	33	140	6,694	33,017	0	13	24	228	77	2
4-Jul	19	159	1,486	34,503	0	13	6	234	37	0
5-Jul	20	179	2,975	37,478	0	13	15	249	29	1
6-Jul	261	440	6,172	43,650	0	13	24	273	27	0
7-Jul	149	589	2,753	46,403	0	13	15	288	29	3
8-Jul	385	974	5,628	52,031	1	14	16	304	44	0
9-Jul	473	1,447	8,644	60,675	0	14	36	340	99	1
10-Jul	346	1,793	4,639	65,314	0	14	23	363	71	4
11-Jul	300	2,093	6,598	71,912	1	15	16	379	59	0
12-Jul	489	2,582	5,788	77,700	0	15	8	387	64	0
13-Jul	14	2,596	683	78,383	0	15	4	391	33	0
14-Jul	26	2,622	1,725	80,108	0	15	8	399	37	0
15-Jul	121	2,743	4,069	84,177	7	22	15	414	72	0
16-Jul	319	3,062	2,990	87,167	10	32	11	425	55	0
17-Jul	194	3,256	3,911	91,078	11	43	5	430	75	1
18-Jul	64	3,320	1,006	92,084	8	51	2	432	51	0
19-Jul	517	3,837	1,554	93,638	76	127	13	445	60	0
20-Jul	275	4,112	1,319	94,957	48	175	3	448	79	0
21-Jul	343	4,455	1,498	96,455	103	278	14	462	114	0
22-Jul	306	4,761	930	97,385	132	410	7	469	79	0
23-Jul	140	4,901	581	97,966	77	487	4	473	94	0
24-Jul	74	4,975	425	98,391	79	566	10	483	68	0
25-Jul	51	5,026	468	98,859	67	633	1	484	71	0
26-Jul	44	5,070	478	99,337	93	726	4	488	42	1
27-Jul	48	5,118	466	99,803	183	909	7	495	48	0
28-Jul	61	5,179	384	100,187	165	1074	1	496	51	0
29-Jul	24	5,203	181	100,368	86	1160	2	498	45	0
30-Jul	10	5,213	105	100,473	59	1219	2	500	30	0
Total		5,213		100,473		1,219		500	2,115	23

Table 3. — Mid-eye to fork length (mm) at age of female and male Chinook salmon and summer chum salmon sampled at East Fork Andreafsky River weir, Alaska, 2011.

Female						Male					
Age	N	Mean	Median	SE	Range	Age	N	Mean	Median	SE	Range
Chinook salmon											
1.2	4	520	525	19.5	475-555	1.2	234	521	520	2.7	360-650
1.3	44	720	730	10.2	570-870	1.3	181	675	672	10.2	505-825
1.4	59	829	830	7	705-955	1.4	19	812	805	12.4	740-945
1.5	1	-	-	-	900	2.3	1	-	-	-	635
UNK	23					UNK	84				
All Ages	131					All Ages	519				
Chum salmon											
0.2	-	-	-	-	-	0.2	4	546	555	18.5	495-580
0.3	187	527	525	1.8	465-585	0.3	182	556	555	2.4	475-640
0.4	236	541	540	1.8	435-615	0.4	332	582	580	1.7	480-670
0.5	-	-	-	-	-	0.5	3	557	560	20.3	520-590
0.6	-	-	-	-	-	0.6	-	-	-	-	-
UNK	27					UNK	31				
All Ages	450					All Ages	552				

Table 4. — Age and sex ratio estimates by stratum of Chinook salmon sampled at East Fork Andreafsky River weir, Alaska, 2011. Standard errors are in parentheses. Season totals are calculated from weighted weekly strata totals. Unknown age data are from unreadable scale samples and are listed for informational purposes. They were not included in age calculations.

					Brood year and age				
					2008	**2007**	**2006**	**2005**	**2004**
Strata	**Run Size(N)**	**Samples Size (n)**	**Unknown Age**	**Percent Female**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**
June 20-July 3	140	66	17	27%(5.5)	0.0%	43%(7.1)	49%(7.2)	08%(4.0)	0.0%
July 4-10	1,653	181	26	15%(2.7)	0.0%	43%(4)	50%(4.0)	06%(2.0)	0.0%
July 11-17	1,463	170	27	23%(3.2)	0.0%	32%(3.9)	48%(4.2)	20%(3.4)	0.0%
July 18-24	1,719	145	22	22%(3.5)	0.0%	49%(4.5)	31%(4.2)	20%(3.6)	<1%(0.2)
July 25-30	238	88	15	16%(3.9)	0.0%	60%(5.8)	25%(5.1)	15%(1.7)	0.0%
Total	5,213	650	107	20%(1.7)	0.0%	43%(2.3)	41%(2.2)	15%(1.7)	<1%(0.2)
Female	1,047	131	23	-	-	04%(2.1)	37%(4.5)	58%(4.8)	01%(1.3)
Male	4,166	519	84	-	-	52%(2.6)	43%(2.5)	04%(1.1)	0.0

Table 5. — Age and sex ratio estimates by stratum of summer chum salmon sampled at East Fork Andreafsky River weir, Alaska, 2011. Standard errors are in parentheses. Season totals are calculated from weighted weekly strata totals. Unknown age data are from unreadable scale samples and are listed for informational purposes. They were not included in age calculations.

					Brood Year Age				
					2008	2007	2006	2005	2004
Strata	Run Size(N)	Samples size (n)	Unknown age	Percent Female	0.2	0.3	0.4	0.5	0.6
June 27-July 3	33,017	372	21	38%(2.5)	<01%(0.3)	21%(2.2)	78%(2.2)	<01%(0.4)	0.0%
July 4-10	32,297	160	9	38%(3.8)	0.0%	31%(3.8)	69%(3.8)	0	0.0%
July 11-17	25,764	160	7	36%(3.8)	<01%(0.7)	45%(4.0)	54%(4.0)	0	0.0%
July 18-24	7,313	167	16	59%(3.8)	<01%(0.7)	56%(4.1)	42%(4.0)	<01%(0.7)	0.0%
July 25-30	2,082	143	5	64%(4.0)	<01%(0.7)	68%(4.0)	31%(4.0)	0	0.0%
Total	100,473	1,002	58	39%(1.8)	<01%(0.2)	35%(1.8)	65%(1.8)	<01%(0.1)	0.0%
Female	39,642	450	27	-	0.0%	35%(2.8)	65%(2.8)	0.0%	-
Male	60,831	552	31	-	<01%(0.3)	33%(2.3)	66%(2.3)	<01%(0.2)	-

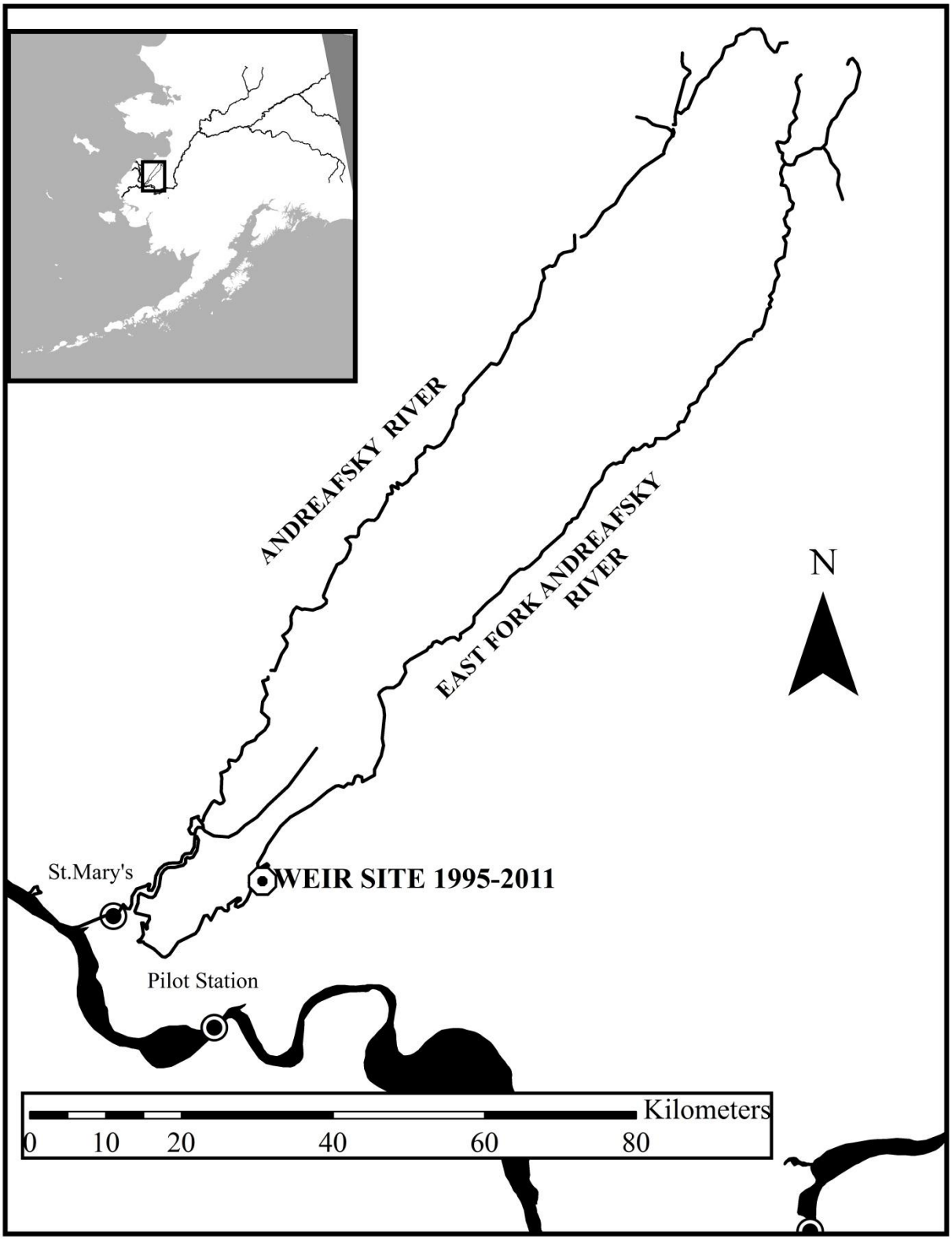


Figure 1. — Weir location on the East Fork Andreafsky River, Alaska, 1995-2011.

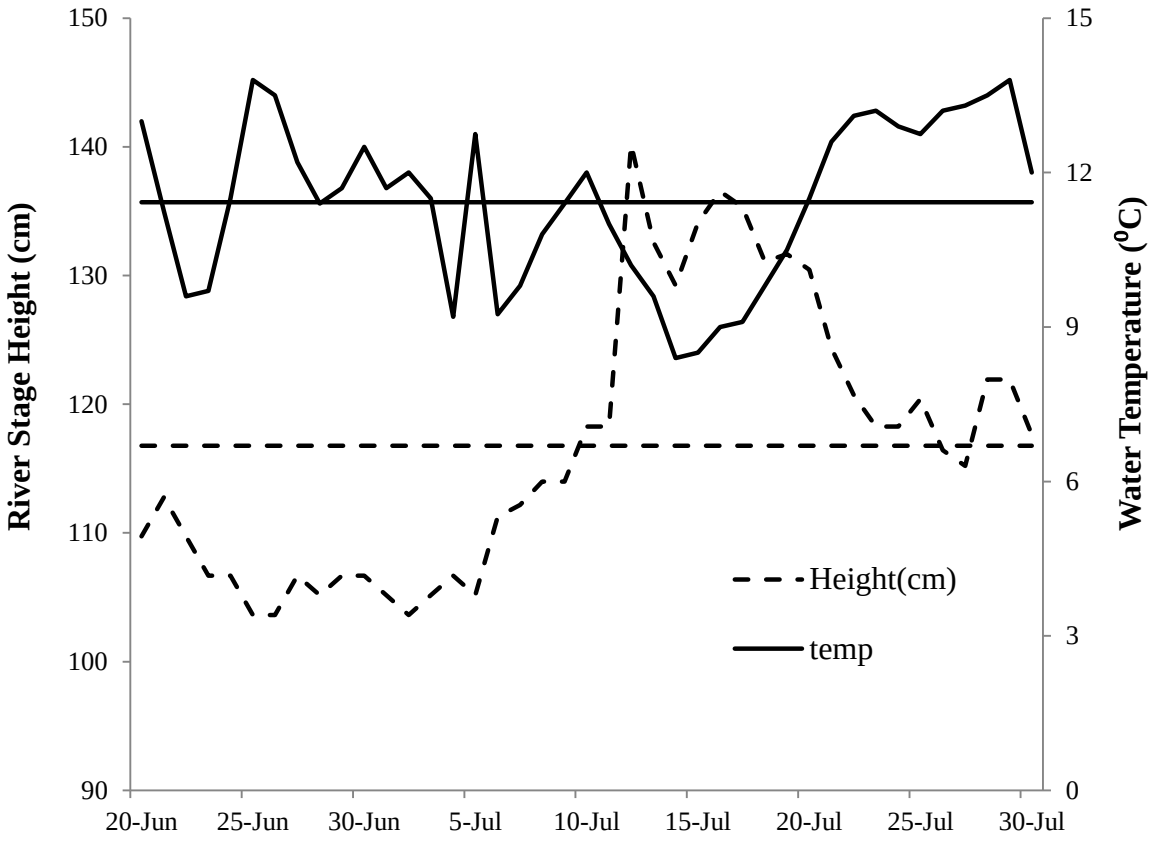


Figure 2. — River stage heights and water temperatures at the East Fork Andreafsky River weir, 2011, with seasonal averages.

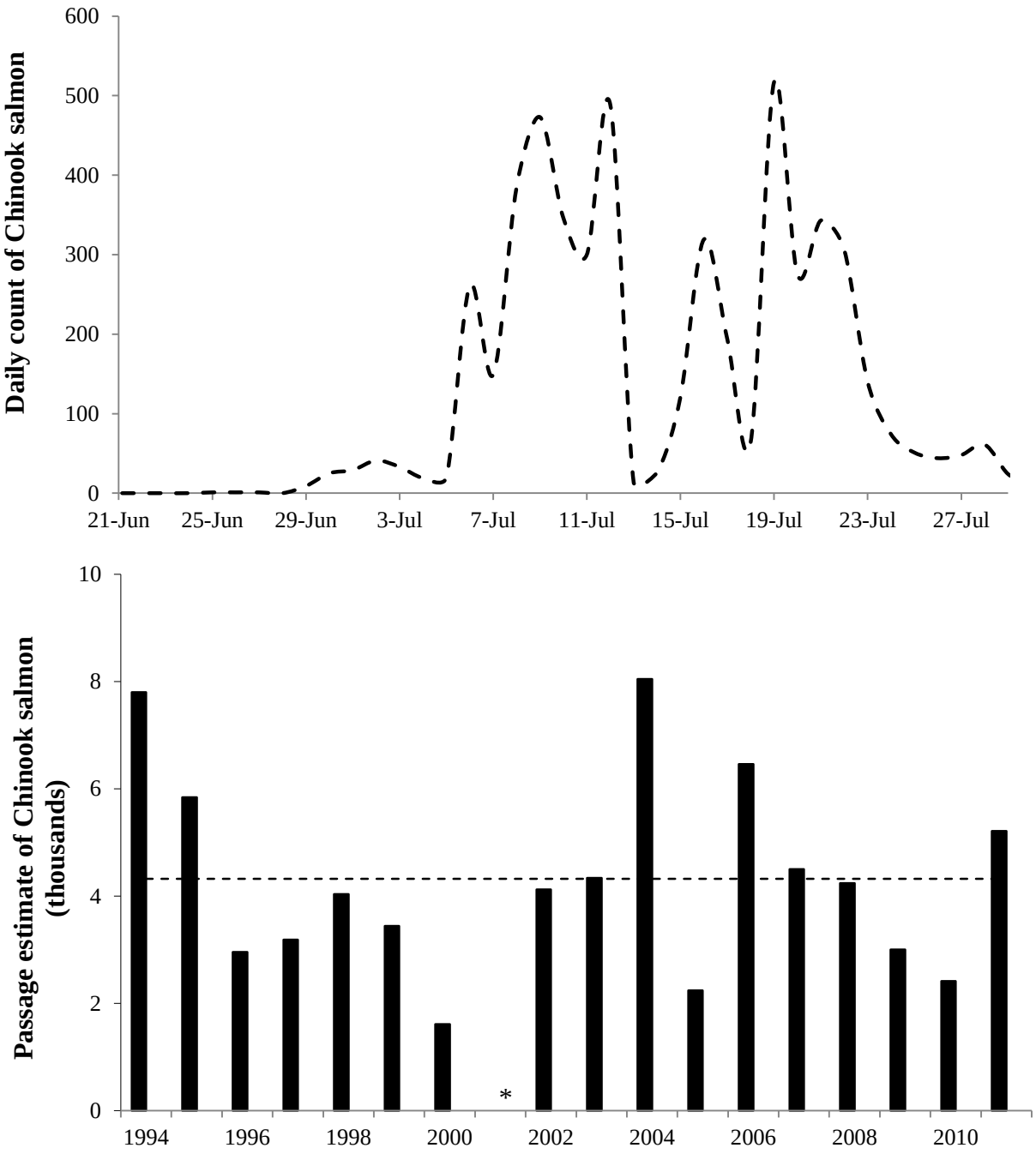


Figure 3. — 2011 daily count and annual escapement estimates of Chinook salmon migrating through the East Fork Andreafsky River weir, Alaska, 1994 to 20011. Historical average is represented by the dashed, horizontal line. Asterisk denotes missing annual count due to high water.

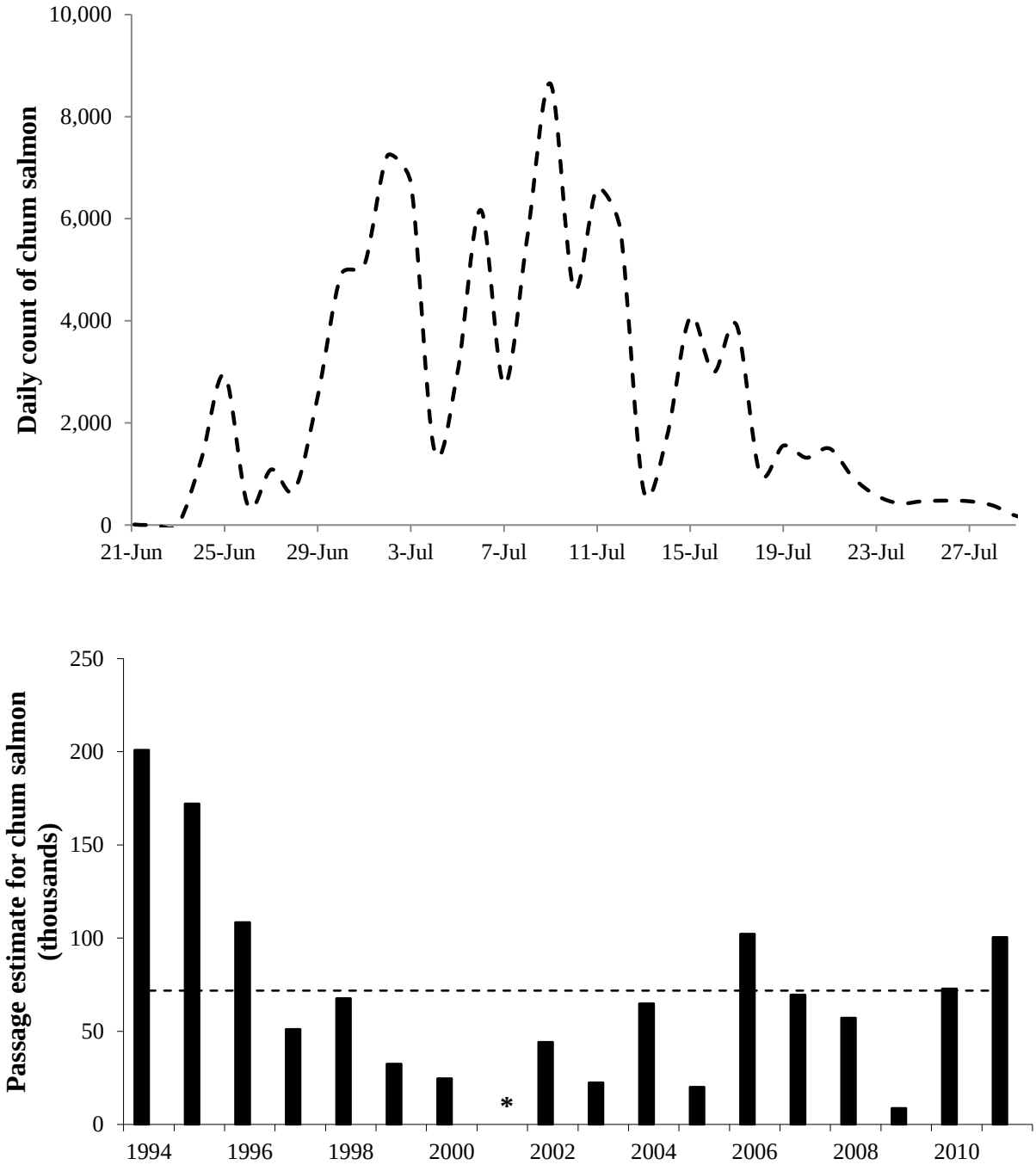


Figure 4. — 2011 daily count and annual escapement estimates of summer chum salmon migrating through the East Fork Andreafsky River weir, Alaska, 1994 to 20011. Historical average is represented by the dashed, horizontal line. Asterisk denotes missing annual count due to high water.

Appendix 1. — Historical Chinook, summer chum, and coho salmon escapement estimates recorded for the Andreafsky River, Alaska, 1954-2011. Data provided by ADF&G from JTC (2012).

	East Fork Andreafsky River									Main stem Andreafsky River				
	Aerial Index Estimates			Sonar, Tower, or Weir			Aerial Index Estimates		
Year	Chinook salmon	Chum salmon	Coho salmon	Chinook salmon	Chum salmon	Coho salmon	Chinook salmon	Chum salmon	Coho salmon
1954		*a*		*a*						2,000 *a*	7,000 *a*	
1955												
1956	336 *b*	15,356 *b*										
1957												
1958	50 *b*	3,500 *b*								150 *b*	30,000 *b*	
1959	150 *b*	4,000 *b*								300 *b*	7,000 *b*	
1960	1,020	10,530								1,220	6,016	
1961	1,003	8,110										
1962	675 *b*	18,040								762 *b*	19,530	
1963												
1964	867	8,863								705	12,810	
1965										355 *b*	14,670 *b*	
1966	361	25,619 *b*								303	18,145	
1967										276 *b*	14,495 *b*	
1968	380	17,600								383 *b*	74,600 *b*	
1969	231 *b*	119,000								374 *b*	159,500 *b*	
1970	665	84,090								574 *b*	91,710 *b*	
1971	1,904	98,095								1,682	71,745	
1972	798 *b*	41,460 *b*								582 *b*	25,573	
1973	825	10,149 *b*								788	51,835	
1974		3,215 *b*								285	33,578	
1975	993	223,485								301	235,954	
1976	818	105,347								643	118,420	
1977	2,008	112,722								1,499	63,120	
1978	2,487	127,050								1,062	57,321	
1979	1,180	66,471								1,134	43,391	
1980	958 *b*	36,823 *b*								1,500	115,457	
1981	2,146 *b*	81,555	1,657 *b*	5,343 *c*	147,312 *c*					231 *b*		
1982	1,274	7,501 *b*			180,078 *c*					851	7,267 *b*	
1983				2,720 *c*	110,608 *c*							
1984	1,573 *b*	95,200 *b*			70,125 *c*					1,993	238,565	
1985	1,617	66,146								2,248	52,750	
1986	1,954	83,931		1,530 *d*	167,614 *d*					3,158	99,373	
1987	1,608	6,687 *b*		2,011 *d*	45,221 *d*					3,281	35,535	
1988	1,020	43,056	1,913	1,339 *d*	68,937 *d*					1,448	45,432	830
1989	1,399	21,460 *b*								1,089		
1990	2,503	11,519 *b*								1,545	20,426 *b*	
1991	1,938	31,886								2,544	46,657	
1992	1,030 *b*	11,308 *b*								2,002 *b*	37,808 *b*	
1993	5,855	10,935 *b*								2,765	9,111 *b*	
1994	300 *b*			7,801	200,981					213 *b*		
1995	1,635			5,841	172,148	10,901				1,108		
1996				2,955	108,450	8,037				624		
1997	1,140			3,186	51,139	9,472				1,510		

Appendix 1. — Continued**.**

	East Fork Andreafsky River						Main stem Andreafsky River			
	Aerial Index Estimates			Sonar, Tower, or Weir			Aerial Index Estimates			
Year	Chinook salmon	Chum salmon	Coho salmon	Chinook salmon	Chum salmon	Coho salmon	Chinook salmon	Chum salmon	Coho salmon	
1998	1,027			4,034	67,720	5,417	*e* 1,249	*b*		
1999		*b*		3,444	32,587	2,963	870	*b*		
2000	1,018			1,609	24,785	8,451	427			
2001	1,065			1,148	*f* 2,134	*f* 15,896	*e* 570			
2002	1,447			4,123	44,194	3,577	977			
2003	1,116	*b*		4,336	22,461	8,231	1,578	*b*		
2004	2,879			8,045	64,883	11,146	1,317			
2005	1,715			2,239	20,127	5,303	1,492			
2006	590	*b*		6,463	102,260	23	*g* 824			
2007	1,758			4,504	69,642	9	*g* 976			
2008	278	*b*		4,242	57,259	2	*g* 262	*b*		
2009	80	*b*		3,004	8,770	4	*g* 1,664			
2010	537	*b*		2,413	72,893	10	*g* 849			
2011	620			5,213	100,473		1,141			
SEG *h*	960 - 1,900			2,100 - 4,900			640 - 1,600			
BEG *i*					65,000 - 130,000					

a Counts for both forks were combined into Andreafsky River count.

b Incomplete survey and/or poor survey timing or conditions resulting in minimal or inaccurate count.

c Sonar count.

d Tower count.

e Incomplete count, missing data not estimated.

f Weir installed too late for an accurate count.

g Incomplete count, weir removed.

h Sustainable Escapement Goals.

i Biological Escapement Goals.

Appendix 2. — Historical daily Chinook salmon escapements recorded at the East Fork Andreafsky River weir 1994-2011. Data for 2001 were not used in calculations and are shown for informational purposes only. Boxes represent quartiles, yellow box indicates midpoint in the run.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15-Jun				0							
16-Jun		0		0							
17-Jun		0		0		0					
18-Jun		0		0		0					
19-Jun		0	0	0		0			0	0	
20-Jun		1	0	0		0			0	0	
21-Jun		0	10	0		0			1	0	
22-Jun		1	0	0		0			20	0	
23-Jun		0	33	14	0	0			0	4	67
24-Jun		2	6	21	0	0			0	2	26
25-Jun		0	0	59	0	0			3	7	15
26-Jun		0	59	0	0	0			1	3	55
27-Jun		41	42	101	1	0			26	12	181
28-Jun		48	19	11	0	0			314	19	534
29-Jun	1	67	6	1	10	0			119	4	290
30-Jun	188	104	8	0	34	47	9		27	0	461
1-Jul	141	81	72	75	93	19	16		319	176	582
2-Jul	54	71	21	24	17	9	39		105	295	25
3-Jul	222	17	205	29	36	0	89		230	22	375
4-Jul	156	55	124	49	75	12	74		5	6	353
5-Jul	651	107	309	98	336	97	38		20	83	263
6-Jul	225	678	258	356	373	42	407		356	136	1,187
7-Jul	1,156	433	280	227	386	114	18		307	336	878
8-Jul	108	155	244	123	204	197	71		130	469	463
9-Jul	351	260	186	49	129	216	17		178	823	503
10-Jul	375	250	111	64	167	256	30		191	48	368
11-Jul	288	382	72	69	255	507	57		264	107	122
12-Jul	581	1,022	52	88	138	214	35		166	345	315
13-Jul	779	697	100	15	62	331	55		191	311	106
14-Jul	433	375	96	16	61	97	18		158	340	105
15-Jul	352	292	62	124	91	22	90	169	140	2	53
16-Jul	389	97	95	274	197	33	76	87	210	7	58
17-Jul	144	46	110	91	263	75	62	41	119	25	54
18-Jul	285	38	55	25	184	63	48	196	94	235	29
19-Jul	161	25	42	70	240	65	34	71	75	158	40
20-Jul	53	37	69	264	67	302	22	107	50	28	57
21-Jul	66	74	51	148	129	55	12	175	29	10	40
22-Jul	62	33	26	35	117	67	21	66	12	2	13
23-Jul	209	24	2	103	57	15	6	15	32	23	17
24-Jul	149	7	4	57	66	54	11	5	16	58	12
25-Jul	25	78	6	0	12	24	10	17	7	31	19
26-Jul	51	21	3	11	8	5	9	7	3	4	5
27-Jul	92	12	6	3	8	34	7	17	6	22	14
28-Jul	20	15	16	29	11	6	3	10	3	108	23
29-Jul	10	9	13	58	23	159	57	41	4	28	19
30-Jul	13	5	7	144	31	80	4	16	2	4	7
31-Jul	10	1	10	2	17	59	20	11	46	0	15
1-Aug	1	8	4	8	20	38	12	8	55	2	13
2-Aug		2	2	4	4	18	4	12	48	5	4
3-Aug		13	2	128	11	42	24	4	10	1	3
4-Aug		5	5	2	1	11	19	8	3	1	6
5-Aug		6	6	1	7	5	14	6	3	4	5
6-Aug		6	2	0	9	2	9	1	4	0	10
7-Aug		19	7	1	10	1	4	11	4	1	8
8-Aug - 23- Sept		121	37	115	74	51	58	47	17	29	247
Total	7,801	5,841	2,955	3,186	4,034	3,444	1,609	**	4,123	4,336	8,045

(continued)

Appendix 2. — Continued.

Date	2005	2006	2007	2008	2009	2010	2011
15-Jun							
16-Jun							
17-Jun							
18-Jun							
19-Jun			0				
20-Jun			0			0	0
21-Jun			0	0		0	0
22-Jun			0	0	0	0	0
23-Jun			0	0	0	0	0
24-Jun			0	0	0	0	0
25-Jun			7	1	0	0	1
26-Jun	16		2	0	0	1	1
27-Jun	2		0	5	0	3	1
28-Jun	42	0	0	1	0	0	0
29-Jun	88	6	4	10	0	13	9
30-Jun	238	51	7	7	0	16	25
1-Jul	11	40	134	14	1	18	29
2-Jul	89	13	197	44	1	41	41
3-Jul	135	51	75	41	2	54	33
4-Jul	114	128	277	50	0	25	19
5-Jul	111	276	141	133	0	41	20
6-Jul	154	437	476	301	3	124	261
7-Jul	271	574	442	610	15	16	149
8-Jul	169	392	157	777	7	36	385
9-Jul	46	86	299	110	0	353	473
10-Jul	7	165	255	7	2	295	346
11-Jul	15	449	86	11	34	69	300
12-Jul	9	1,108	653	23	247	92	489
13-Jul	58	201	103	53	106	24	14
14-Jul	108	67	96	76	142	34	26
15-Jul	49	117	28	265	13	27	121
16-Jul	55	262	25	355	13	278	319
17-Jul	30	714	34	277	251	274	194
18-Jul	14	371	132	283	37	21	64
19-Jul	22	264	78	130	76	7	517
20-Jul	17	164	35	57	53	9	275
21-Jul	50	161	95	58	112	32	343
22-Jul	51	166	249	130	201	22	306
23-Jul	15	117	59	104	222	47	140
24-Jul	22	48	63	75	126	59	74
25-Jul	46	25	102	49	104	59	51
26-Jul	4	8	33	35	39	81	44
27-Jul	4	2	149	26	37	23	48
28-Jul	4		4	61	262	94	61
29-Jul	0		4	39	221	101	24
30-Jul	4		3	24	172	14	10
31-Jul	3				178	10	
1-Aug	2				171		
2-Aug	2				94		
3-Aug	8				62		
4-Aug	4						
5-Aug	8						
6-Aug	4						
7-Aug	3						
8-Aug - 23- Sept	135						
Total	2,239	6,463	4,504	4,242	3,004	2,413	5,213

Appendix 3. – Historical daily summer chum salmon estimates recorded at the East Fork Andreafsky River weir 1994-2011. Data for 2001 were not used in calculations and are shown for informational purposes only. Boxes represent quartiles, yellow box indicates midpoint in the run.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15-Jun				0							
16-Jun		52		1							
17-Jun		332		4		0					
18-Jun		191		71		0					
19-Jun		423	62	539		0			0	0	
20-Jun		2,198	424	981		0			0	0	
21-Jun		861	3,315	192		0			117	2	
22-Jun		1,170	1,036	53		0			1,782	87	
23-Jun		228	11,195	3,141	13	1			0	564	3,045
24-Jun		1,951	798	1,620	18	1			6	182	1,062
25-Jun		364	303	1,422	264	0			522	484	985
26-Jun		504	7,306	208	175	7			694	183	2,467
27-Jun		12,620	3,435	1,691	535	8			2,448	396	4,638
28-Jun		11,201	1,463	1,196	65	0			6,754	546	8,461
29-Jun	609	9,256	2,335	61	3,153	331			1,765	219	3,807
30-Jun	19,254	10,938	314	80	4,585	4,459	837		836	271	7,081
1-Jul	12,435	8,654	9,164	1,537	4,003	765	1,725		4,403	928	1,590
2-Jul	2,840	5,553	3,326	619	652	459	1,460		2,467	339	153
3-Jul	4,973	2,710	8,973	756	1,687	24	1,750		2,291	713	5,689
4-Jul	13,321	10,678	10,018	1,264	3,561	3,000	2,070		28	175	3,940
5-Jul	12,552	10,026	7,355	831	7,996	4,605	2,300		347	484	2,011
6-Jul	4,043	23,584	3,351	3,428	6,030	1,185	3,717		4,423	1,051	1,791
7-Jul	27,527	8,514	3,124	2,980	4,696	1,619	72		2,254	1,376	2,474
8-Jul	5,251	732	4,771	2,440	3,088	1,569	1,548		845	2,476	2,096
9-Jul	3,883	4,808	3,500	1,799	845	1,754	942		2,265	2,025	1,990
10-Jul	12,416	6,473	2,303	3,195	1,003	2,135	727		1,732	244	2,069
11-Jul	6,896	6,072	1,275	1,792	4,003	1,897	855		1,221	412	1,609
12-Jul	8,424	3,973	1,497	1,738	4,401	501	477		1,099	1,762	1,815
13-Jul	14,628	4,552	1,680	1,062	829	710	911		1,055	586	1,071
14-Jul	11,611	2,990	1,038	1,302	1,248	1,223	352		544	254	896
15-Jul	8,275	2,874	935	3,222	2,160	412	638	196	1,014	33	605
16-Jul	4,690	3,449	1,280	2,441	2,747	507	551	133	581	123	569
17-Jul	4,886	2,739	774	1,150	3,038	547	464	95	420	445	465
18-Jul	4,532	1,495	852	715	1,580	494	377	229	492	1,078	326
19-Jul	2,977	651	1,848	624	1,365	666	290	102	392	708	217
20-Jul	1,091	1,150	1,721	1,220	370	816	206	74	192	681	276
21-Jul	1,351	807	1,116	800	335	242	424	228	153	283	142
22-Jul	2,228	591	605	668	304	240	280	72	61	47	59
23-Jul	1,320	742	246	405	248	201	116	29	201	306	77
24-Jul	868	290	291	313	200	173	84	32	98	222	116
25-Jul	1,349	1,214	196	121	220	131	159	155	26	348	171
26-Jul	1,977	521	365	339	166	73	130	116	22	218	85
27-Jul	2,196	605	278	400	130	132	64	110	60	220	69
28-Jul	841	265	738	219	202	92	43	88	123	389	73
29-Jul	564	211	334	234	145	245	173	78	17	220	52
30-Jul	524	248	272	131	115	242	70	37	36	61	37
31-Jul	410	94	260	86	140	200	172	10	119	80	34
1-Aug	239	160	93	134	191	158	89	24	81	104	17
2-Aug		81	158	81	91	118	125	40	33	111	21
3-Aug		147	91	182	76	124	109	28	36	40	28
4-Aug		59	192	48	56	117	83	17	40	91	22
5-Aug		77	132	101	73	45	57	13	3	182	25
6-Aug		115	215	77	71	17	31	2	7	52	31
7-Aug		76	163	29	104	11	5	7	13	85	33
8-Aug - 23-Sept		1,879	1,934	1,396	743	331	302	219	76	575	593
Total	200,981	172,148	108,450	51,139	67,720	32,587	24,785	**	44,194	22,461	64,883

(continued)

Appendix 3. — Continued.

Date	2005	2006	2007	2008	2009	2010	2011
15-Jun							
16-Jun							
17-Jun							
18-Jun							
19-Jun			0				
20-Jun			0			0	146
21-Jun			0	1		0	19
22-Jun			2	57	0	0	2
23-Jun			0	30	0	2	21
24-Jun			29	73	6	0	1,294
25-Jun			1166	34	10	6	2,935
26-Jun	256		348	1160	0	410	381
27-Jun	9		70	902	5	285	1,088
28-Jun	424	1,272	362	865	19	53	684
29-Jun	473	2,822	1644	1920	289	5435	2,522
30-Jun	432	14,912	1785	1095	78	3088	4,900
1-Jul	239	10,229	3581	1718	228	1534	5,090
2-Jul	1,081	2,395	3463	2963	417	3196	7,241
3-Jul	1,063	1,272	2694	2367	114	5269	6,694
4-Jul	1,238	2,822	4834	4572	10	3338	1,486
5-Jul	993	14,912	4725	8125	17	2689	2,975
6-Jul	1,218	10,229	3852	5285	1137	7086	6,172
7-Jul	1,839	2,395	1980	2598	583	1136	2,753
8-Jul	1,270	7,291	1919	2763	42	5336	5,628
9-Jul	1,112	14,018	4559	1438	11	7921	8,644
10-Jul	1,370	9,389	6021	193	176	3878	4,639
11-Jul	195	7,738	1455	300	549	1808	6,598
12-Jul	197	4,225	2362	1276	634	1470	5,788
13-Jul	1,458	3,614	1219	1955	269	702	683
14-Jul	1,242	2,351	1394	2019	547	1391	1,725
15-Jul	557	3,478	860	2322	411	1405	4,069
16-Jul	449	2,631	1867	3646	498	4138	2,990
17-Jul	196	1,609	3294	1497	483	2378	3,911
18-Jul	246	725	3834	1324	224	281	1,006
19-Jul	141	330	1349	896	176	400	1,554
20-Jul	523	1,127	468	691	186	525	1,319
21-Jul	493	1,441	700	594	235	1189	1,498
22-Jul	182	2,564	1895	572	332	930	930
23-Jul	167	1,637	1417	535	175	785	581
24-Jul	54	1,294	1208	383	164	896	425
25-Jul	80	924	1784	335	113	1030	468
26-Jul	28	944	645	142	165	686	478
27-Jul	32	921	444	191	72	585	466
28-Jul	100		95	149	148	956	384
29-Jul	112		179	168	47	284	181
30-Jul	74		139	105	33	200	105
31-Jul	79				33	192	
1-Aug	50				25		
2-Aug	25				64		
3-Aug	23				45		
4-Aug	5						
5-Aug	24						
6-Aug	30						
7-Aug	14						
8-Aug - 23-Sept	334						
Total	20,127	131,511	69,642	57,259	8,770	72,893	100,473

Appendix 4. — Historical daily coho salmon estimates recorded at the East Fork Andreafsky River weir, 1995-2011. Data for 1998 and 2001 were not used in calculations and are shown for informational purposes only.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15-Jun -										
4-Aug	1	85	0	16	9	52	0	1	12	11
5-Aug	0	20	0	8	4	14	0	0	2	8
6-Aug	0	10	0	5	4	13	0	0	4	10
7-Aug	1	26	1	16	0	12	0	0	28	14
8-Aug	1	20	0	9	0	35	0	0	25	16
9-Aug	3	26	0	5	1	79	0	0	27	98
10-Aug	8	138	0	8	2	125	0	1	5	62
11-Aug	12	105	0	3	2	89	0	0	9	115
12-Aug	5	50	10	4	5	51	0	0	19	86
13-Aug	3	16	47	111	1	211	0	0	40	78
14-Aug	3	11	35	71	1	137	1	0	194	71
15-Aug	9	19	6	9	0	64	22	0	146	63
16-Aug	5	276	8	61	5	34	33	0	98	56
17-Aug	11	92	7		2	23	5	0	50	48
18-Aug	24	179	12		0	137	5	0	2	163
19-Aug	41	1,052	13	8	0	108	51	1	7	384
20-Aug	24	100	50		1	333	532	0	21	170
21-Aug	95	149	414		42	303	270	0	11	185
22-Aug	246	9	222		48	59	312	3	3	150
23-Aug	305	32	22		0	10	343	6	24	80
24-Aug	414	12	16		26	44	583	3	263	185
25-Aug	245	1,539	577		8	533	217	7	1,744	243
26-Aug	692	449	150		4	1,401	857	0	634	453
27-Aug	1,436	5	10		4	1,643	382	0	288	17
28-Aug	368	1	24		3	279	403	2	197	4
29-Aug	938	179	2,335	371	0	626	103	0	243	38
30-Aug	335	1,489	2,714	618	2	278	1,078	0	552	178
31-Aug	265	374	122	568	1	192	2,264	0	729	490
1-Sep	444	374	73	336	411	358	1,576	0	172	505
2-Sep	863	147	53	17	162	238		14	107	897
3-Sep	14	100	421	80	1,255	162		29	9	234
4-Sep	29	250	355	490	704	160		43	646	167
5-Sep	6	337	219	228	122	39		640	275	609
6-Sep	21	78	514	591	40	46		738	14	1,550
7-Sep	164	84	435	12	0	52		413	42	1,011
8-Sep	2,403	24	169	0	14	48		345	459	578
9-Sep	854	16	223	94	19	55		103	268	337
10-Sep	391	1	52	555	41	94	85	237	9	535
11-Sep	127	0	83	1,104	20	31	30	117	211	259
12-Sep	95	0	64	6		79	20	726	231	13
13-Sep		0	16	13		30	43	113	399	57
14-Sep		0				22	21	35	8	37
15-Sep		3				16	16		4	201
16-Sep		160				28				240
17-Sep						19				241
18-Sep						3				42
19-Sep						5				157
20-Sep						5				
21-Sep						34				
22-Sep						32				
23-Sep						10				
Total	10,901	8,037	9,472	5,417	2,963	8,451	9,252	3,577	8,231	11,146

****** = incomplete count, missing data not estimated.

***** = incomplete count, weir removed.

(continued)

Appendix 4. — Continued.

Date	2005	2006	2007	2008	2009	2010	2011
15-Jun - 4-Aug	2	23	9	2	4	10	0
5-Aug	0						
6-Aug	0						
7-Aug	1						
8-Aug	4						
9-Aug	2						
10-Aug	2						
11-Aug	0						
12-Aug	0						
13-Aug	0						
14-Aug	4						
15-Aug	9						
16-Aug	37						
17-Aug	6						
18-Aug	173						
19-Aug	24						
20-Aug	4						
21-Aug	2						
22-Aug	2						
23-Aug	21						
24-Aug	101						
25-Aug	19						
26-Aug	102						
27-Aug	128						
28-Aug	1,084						
29-Aug	475						
30-Aug	647						
31-Aug	218						
1-Sep	23						
2-Sep	23						
3-Sep	476						
4-Sep	483						
5-Sep	77						
6-Sep	128						
7-Sep	207						
8-Sep	80						
9-Sep	194						
10-Sep	343						
11-Sep	202						
12-Sep							
13-Sep							
14-Sep							
15-Sep							
16-Sep							
17-Sep							
18-Sep							
19-Sep							
20-Sep							
21-Sep							
22-Sep							
23-Sep							
Total	5,303	23	9	2	4	10	0

** = incomplete count, missing data not estimated.
* = incomplete count, weir removed.

Appendix 5. – Historical daily pink salmon escapement estimates recorded at the East Fork Andreafsky River weir, 1994-2011. Data for 2001 were not used in calculations and are shown for informational purposes only.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15-Jun				0							
16-Jun		0		0							
17-Jun		0		0		0					
18-Jun		0		0		0					
19-Jun		0	12	0		0			0	0	
20-Jun		0	4	0		0			0	0	
21-Jun		0	40	0		0			52	0	
22-Jun		0	42	0		0			462	0	
23-Jun		0	157	0	0	0			0	0	19
24-Jun		0	67	0	0	0			22	0	15
25-Jun		0	24	0	8	0			148	3	24
26-Jun		0	153	0	3	0			338	0	102
27-Jun		1	218	1	22	0			431	6	189
28-Jun		0	80	0	2	0			7,808	4	341
29-Jun	8	2	78	0	112	0			5,076	3	374
30-Jun	451	3	41	0	258	0	18		1,509	0	1,671
1-Jul	409	13	184	2	750	0	5		6,192	16	1,049
2-Jul	194	4	107	0	65	0	383		3,345	12	140
3-Jul	305	4	347	0	704	0	52		6,876	13	1,186
4-Jul	780	5	1,254	1	1,008	0	224		257	13	2,327
5-Jul	1,027	9	6,678	0	3,595	0	162		1,626	16	5,175
6-Jul	772	98	4,676	2	4,136	2	1,228		13,433	24	4,203
7-Jul	4,026	77	3,834	0	4,292	2	354		10,268	94	17,994
8-Jul	1,736	4	7,472	1	2,968	1	972		4,815	172	13,079
9-Jul	4,263	18	8,905	2	1,382	2	1,680		8,765	259	16,044
10-Jul	4,744	33	10,290	1	1,169	10	897		12,942	16	22,171
11-Jul	3,313	23	5,822	2	9,872	20	7,849		10,764	43	15,664
12-Jul	8,447	100	4,662	4	21,285	17	2,726		9,207	185	15,661
13-Jul	13,568	109	9,484	6	11,399	18	7,044		9,161	173	15,313
14-Jul	24,842	94	11,760	1	5,846	7	1,468		7,819	189	25,780
15-Jul	22,460	81	9,754	35	21,785	2	966	10	6,958	28	16,578
16-Jul	20,612	64	13,476	31	11,087	2	1,206	4	8,224	13	22,322
17-Jul	27,053	60	12,222	13	23,930	4	1,446	5	6,724	96	16,143
18-Jul	18,277	31	12,682	5	31,639	4	1,686	26	8,701	702	14,713
19-Jul	20,792	15	14,282	6	27,014	14	1,926	15	6,058	459	15,635
20-Jul	23,511	30	17,477	4	7,204	69	2,170	47	1,983	288	28,631
21-Jul	10,872	40	18,780	4	4,672	38	2,549	61	1,239	98	19,851
22-Jul	8,975	48	13,018	4	2,460	41	1,143	19	564	18	12,446
23-Jul	17,692	77	4,744	5	3,512	25	454	18	1,060	107	9,880
24-Jul	15,120	25	3,778	2	7,181	23	609	38	1,092	107	9,973
25-Jul	3,566	216	2,473	0	5,278	22	1,055	124	385	124	12,352
26-Jul	10,225	88	3,365	6	3,496	11	335	53	429	43	12,184
27-Jul	13,821	37	3,768	13	1,186	24	731	68	232	47	10,978
28-Jul	15,302	20	5,036	9	1,496	11	612	94	305	130	9,686
29-Jul	9,736	14	1,035	20	1,134	26	415	56	49	140	7,911
30-Jul	6,159	29	205	26	982	13	202	22	62	29	5,421
31-Jul	2,476	11	706	2	1,315	2	244	10	232	65	4,258
1-Aug	996	22	169	7	962	(10)	145	17	131	69	2,669
2-Aug		23	107	2	474	5	129	19	61	54	2,342
3-Aug		44	127	8	440	48	81	17	73	33	1,206
4-Aug		20	300	3	303	60	65	12	34	34	843
5-Aug		17	237	3	127	28	49	5	11	35	890
6-Aug		22	61	1	73	14	33	10	13	17	729
7-Aug		37	109	1	104	13	17	10	7	20	789
8-Aug - 23-Sept		304	535	196	478	175	161	60	48	306	2,719
Total	316,530	1,972	214,837	429	227,208	743	43,491	820	165,991	4,303	399,670

****** = incomplete count, missing data not estimated.

(continued)

Appendix 5. — Continued**.**

Date	2005	2006	2007	2008	2009	2010	2011
15-Jun							
16-Jun							
17-Jun							
18-Jun							
19-Jun			0				
20-Jun			0			0	0
21-Jun			0	0		0	0
22-Jun			0	10	0	2	0
23-Jun			0	13	0	0	0
24-Jun			0	5	0	2	2
25-Jun			0	83	0	8	11
26-Jun	0		0	214	0	69	0
27-Jun	2		0	343	0	105	0
28-Jun	10	43	0	393	0	8	0
29-Jun	27	54	3	964	0	1,756	0
30-Jun	97	314	2	580	0	2,641	0
1-Jul	15	281	5	883	0	1,284	0
2-Jul	89	134	38	2,197	2	8,021	0
3-Jul	453	326	36	1,969	2	7,348	0
4-Jul	652	1,431	143	4,814	0	3,307	0
5-Jul	985	281	184	19,968	1	1,633	0
6-Jul	2,334	134	251	19,672	6	4,088	0
7-Jul	3,071	326	164	24,204	26	246	0
8-Jul	2,443	1,431	125	16,687	38	3,532	1
9-Jul	1,692	1,325	278	4,900	9	25,726	0
10-Jul	1,266	3,092	461	331	9	28,744	0
11-Jul	1,453	8,096	112	247	57	12,550	1
12-Jul	385	13,219	315	645	73	10,095	0
13-Jul	2,865	7,941	74	1,351	84	6,127	0
14-Jul	5,106	11,605	129	1,559	94	5,145	0
15-Jul	2,489	13,327	103	3,432	94	6,053	7
16-Jul	1,992	14,844	367	6,532	74	37,603	10
17-Jul	678	7,204	518	6,793	90	42,852	11
18-Jul	945	1,117	843	7,304	125	12,174	8
19-Jul	450	2,858	524	7,461	99	10,984	76
20-Jul	1,140	2,816	642	5,356	94	13,445	48
21-Jul	1,852	8,969	342	6,588	239	12,256	103
22-Jul	814	17,205	1,040	2,759	133	15,201	132
23-Jul	723	18,690	393	2,995	183	11,412	77
24-Jul	256	18,357	306	5,388	191	6,490	79
25-Jul	158	13,319	1,231	2,986	83	10,558	67
26-Jul	425	16,186	475	2,450	104	9,282	93
27-Jul	307	11,435	403	4,106	107	9,708	183
28-Jul	889		143	7,982	156	7,151	165
29-Jul	744		206	8,201	45	2,908	86
30-Jul	687		236	7,543	32	4,733	59
31-Jul	341				38	3,811	
1-Aug	430				28		
2-Aug	140				50		
3-Aug	79				29		
4-Aug	55						
5-Aug	91						
6-Aug	114						
7-Aug	41						
8-Aug - 23-Sept	245						
Total	39,030	196,360	10,092	189,908	2,395	339,058	1,219

Appendix 6. – Historical daily sockeye salmon estimates recorded at the East Fork Andreafsky River weir, 1994-2011. Data for 2001 were not used in calculations and are shown for informational purposes only.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15-Jun				0							
16-Jun		0		0							
17-Jun		0		0		0					
18-Jun		0		0		0				0	
19-Jun		0	0	0		0			0	0	
20-Jun		0	0	0		0			0	0	
21-Jun		0	0	0		0			0	0	
22-Jun		0	0	0		0			0	0	
23-Jun		0	0	0	0	0			0	0	0
24-Jun		0	0	0	0	0			0	0	0
25-Jun		0	0	0	0	0			0	0	0
26-Jun		0	0	0	0	0			0	0	0
27-Jun		0	0	0	0	0			0	0	1
28-Jun		0	0	0	0	0			0	0	2
29-Jun	0	0	0	1	3	1			0	1	5
30-Jun	0	0	0	0	0	0	0		0	0	2
1-Jul	0	2	0	1	0	0	0		0	0	0
2-Jul	0	0	6	0	0	0	0		0	0	3
3-Jul	0	1	9	0	0	0	0		0	0	5
4-Jul	0	0	16	0	0	1	0		0	1	3
5-Jul	0	1	6	0	0	8	0		0	4	9
6-Jul	0	4	1	0	0	1	0		1	4	7
7-Jul	2	0	7	1	0	2	0		0	4	22
8-Jul	1	0	0	0	3	6	0		0	2	18
9-Jul	0	0	10	0	0	2	0		0	2	14
10-Jul	0	1	6	1	0	0	0		0	13	15
11-Jul	1	1	6	0	4	7	1		0	14	18
12-Jul	0	0	8	0	8	0	0		1	4	16
13-Jul	0	0	7	0	3	0	0		0	4	19
14-Jul	0	0	9	2	0	0	1		0	1	10
15-Jul	1	0	4	1	10	0	0	0	0	8	3
16-Jul	2	0	5	2	7	1	0	0	3	13	6
17-Jul	0	0	4	1	5	5	0	0	1	23	9
18-Jul	2	3	8	1	13	2	0	1	2	0	7
19-Jul	0	0	7	0	17	0	0	0	3	9	12
20-Jul	3	1	6	1	3	2	0	0	1	3	12
21-Jul	2	2	3	0	1	0	0	0	1	1	7
22-Jul	0	0	4	2	6	0	0	4	1	8	2
23-Jul	0	0	4	1	3	0	0	1	2	11	7
24-Jul	1	0	1	0	1	0	0	2	4	11	10
25-Jul	1	8	1	0	9	1	0	1	0	2	16
26-Jul	1	2	3	0	0	0	0	0	0	15	9
27-Jul	5	1	3	0	0	0	0	2	1	25	16
28-Jul	4	0	2	3	6	0	0	0	2	19	6
29-Jul	3	1	0	3	5	0	0	0	0	9	5
30-Jul	2	3	0	2	5	1	1	0	0	18	6
31-Jul	0	0	5	0	4	1	1	0	4	7	7
1-Aug	2	4	1	3	5	0	0	0	3	16	8
2-Aug		0	1	2	1	0	0	0	3	4	9
3-Aug		3	1	1	6	0	1	1	0	11	3
4-Aug		0	4	0	4	1	1	0	0	40	7
5-Aug		0	1	0	3	0	1	0	0	5	2
6-Aug		0	4	0	2	2	0	0	1	11	8
7-Aug		1	3	0	5	0	0	0	0	9	9
8-Aug - 23-Sept	0	74	82	71	46	69	72	3	9	162	153
Total	33	113	248	100	188	113	79	15	43	494	508

* * = incomplete count, missing data not estimated.

* = incomplete count, weir removed.

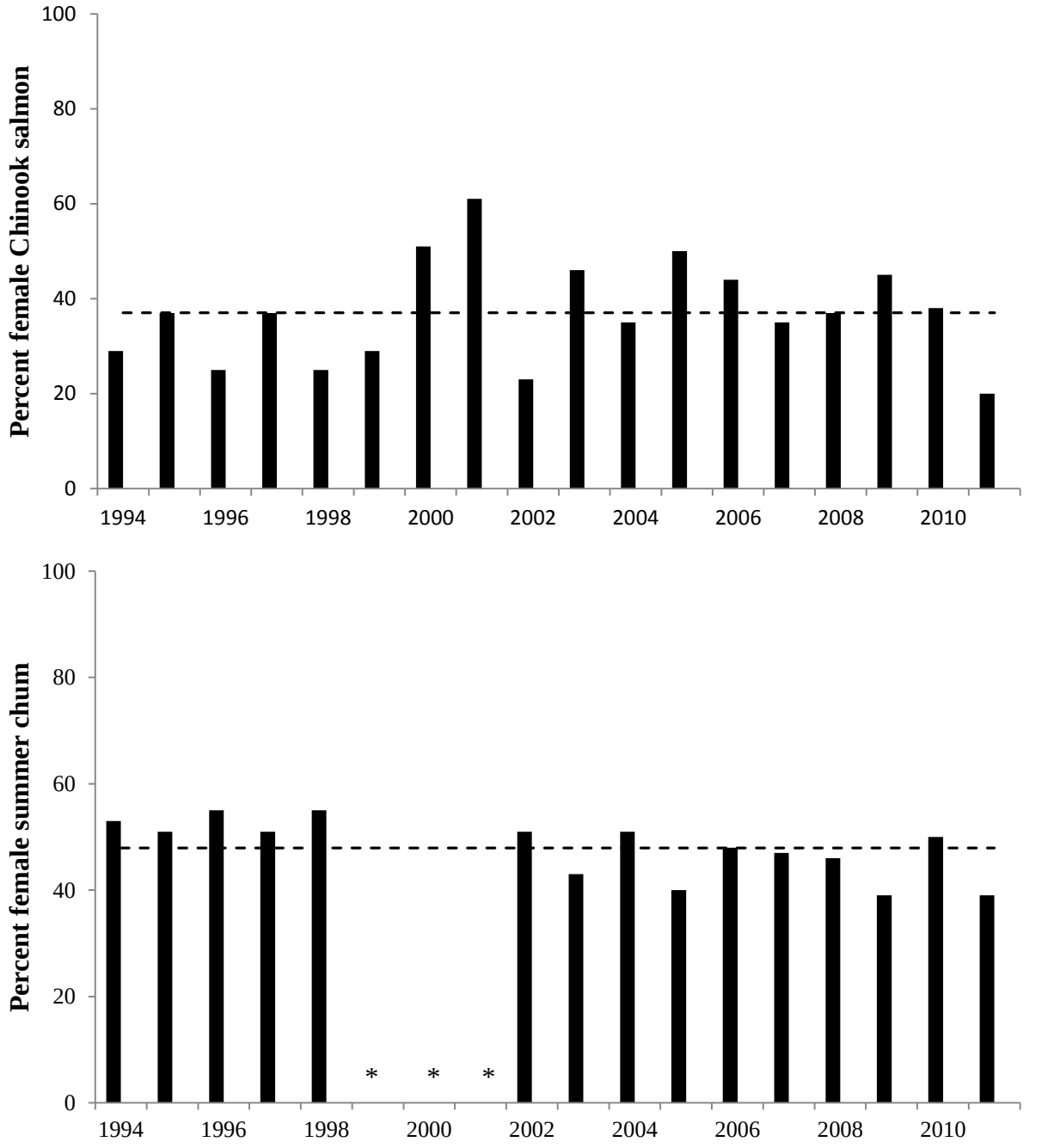
Appendix 6. — continued

Date	2005	2006	2007	2008	2009	2010	2011
15-Jun							
16-Jun							
17-Jun							
18-Jun							
19-Jun			0				
20-Jun			0			0	1
21-Jun			0	0		0	0
22-Jun			0	0	0	0	0
23-Jun			0	0	0	1	3
24-Jun			0	0	0	0	5
25-Jun			0	0	0	1	12
26-Jun	0		0	0	0	2	10
27-Jun	0		1	0	0	0	16
28-Jun	0	0	0	0	0	0	18
29-Jun	0	0	0	0	0	9	31
30-Jun	1	0	0	0	1	1	33
1-Jul	1	0	6	1	0	1	42
2-Jul	0	0	8	16	0	2	33
3-Jul	0	9	2	10	0	2	24
4-Jul	0	50	17	29	0	6	6
5-Jul	0	15	5	27	0	10	15
6-Jul	0	27	0	15	5	5	24
7-Jul	0	16	6	18	3	3	15
8-Jul	0	12	6	25	0	6	16
9-Jul	0	13	9	3	1	9	36
10-Jul	0	12	6	2	3	15	23
11-Jul	0	16	2	2	5	5	16
12-Jul	1	20	6	5	9	2	8
13-Jul	0	4	2	5	2	3	4
14-Jul	15	3	1	3	5	1	8
15-Jul	0	7	1	15	2	1	15
16-Jul	1	5	2	6	2	7	11
17-Jul	0	18	4	5	6	2	5
18-Jul	0	21	5	2	3	2	2
19-Jul	0	26	5	5	4	5	13
20-Jul	0	21	3	6	1	5	3
21-Jul	2	32	1	5	2	5	14
22-Jul	0	12	4	2	2	3	7
23-Jul	0	31	4	9	5	12	4
24-Jul	5	19	4	3	4	3	10
25-Jul	5	15	8	5	3	6	1
26-Jul	2	13	8	12	6	9	4
27-Jul	5	9	4	12	1	7	7
28-Jul	4		5	7	4	3	1
29-Jul	7		5	7	2	3	2
30-Jul	1		1	10	1	3	2
31-Jul	1				0	9	
1-Aug	0				2		
2-Aug	0				0		
3-Aug	0				0		
4-Aug	0						
5-Aug	2						
6-Aug	4						
7-Aug	0						
8-Aug - 23-Sept	94						
Total	151	426	141	272	84	169	500

Appendix 7. — Percent female by year for Chinook and chum salmon. Asterisks denote unavailable data.

Year	Chinook	Summer chum
1994	29%	53%
1995	37%	51%
1996	25%	55%
1997	37%	51%
1998	25%	55%
1999	29%	*
2000	51%	*
2001	61%	*
2002	23%	51%
2003	46%	43%
2004	35%	51%
2005	50%	40%
2006	44%	48%
2007	35%	47%
2008	37%	46%
2009	45%	39%
2010	38%	50%
2011	20%	39%
Average	37%	47%

Appendix 8. — Annual estimate of percent female for Chinook salmon and summer chum salmon from 1994-2011 at the East Fork Andreafsky River weir, Alaska. Dashed line denotes average percent female from 1994-2011**.**



*data unavailable

Appendix 9. — 2011 field season water quality data at the E.F. Andreafsky River weir, Alaska, 2011. Reported values are the arithmetic means for morning and evening readings.

Date	Water Temp (^{0}C)	Height (cm)	Dissolved Oxygen (mg/L)	Conductivity (µs/cm)	pH
20-Jun	13.0	109.7	10.7	65.4	7.8
21-Jun	11.3	112.8	11.5	63.3	7.7
22-Jun	9.6	109.7	11.9	60.3	7.7
23-Jun	9.7	106.7	11.9	60.4	7.7
24-Jun	11.5	106.7	11.6	64.5	7.7
25-Jun	13.8	103.6	11.0	68.5	7.8
26-Jun	13.5	103.6	11.6	68.0	8.0
27-Jun	12.2	106.7	11.1	66.6	7.8
28-Jun	11.4	105.2	11.3	64.7	7.9
29-Jun	11.7	106.7	11.2	66.2	7.9
30-Jun	12.5	106.7	10.7	67.0	7.9
1-Jul	11.7	105.2	10.7	66.9	7.9
2-Jul	12.0	103.6	10.8	67.7	7.9
3-Jul	11.5	105.2	11.0	69.0	7.9
4-Jul	9.2	106.7	11.4	66.1	7.9
5-Jul	12.8	105.2	12.6	61.6	7.9
6-Jul	9.3	111.3	11.8	61.0	7.9
7-Jul	9.8	112.2	11.9	59.3	7.8
8-Jul	10.8	114.0	11.3	61.0	7.9
9-Jul	11.4	114.0	10.2	62.2	7.7
10-Jul	12.0	118.3	11.4	59.0	7.6
11-Jul	11.0	118.3	11.1	59.3	7.7
12-Jul	10.2	140.2	12.0	52.6	7.8
13-Jul	9.6	132.6	12.1	51.2	7.8
14-Jul	8.4	129.2	12.1	54.1	7.8
15-Jul	8.5	134.1	11.8	54.4	7.9
16-Jul	9.0	136.6	12.0	54.4	7.7
17-Jul	9.1	135.3	11.1	56.0	7.7
18-Jul	9.8	131.1	12.3	57.8	8.1
19-Jul	10.5	131.7	12.4	58.8	8.3
20-Jul	11.5	130.5	12.0	62.0	7.9
21-Jul	12.6	124.4	10.1	63.6	7.7
22-Jul	13.1	120.7	11.2	67.1	8.0
23-Jul	13.2	118.3	10.1	68.3	7.9
24-Jul	12.9	118.3	11.0	68.6	7.9
25-Jul	12.8	120.4	11.0	68.2	7.9
26-Jul	13.2	116.4	11.1	70.0	7.9
27-Jul	13.3	115.2	11.1	70.0	8.0
28-Jul	13.5	121.9	11.2	68.7	7.9
29-Jul	13.8	121.9	11.3	71.0	8.0
30-Jul	12.0	117.7	12.5	68.6	8.0
Average	11.4	116.8	11.4	63.2	7.8